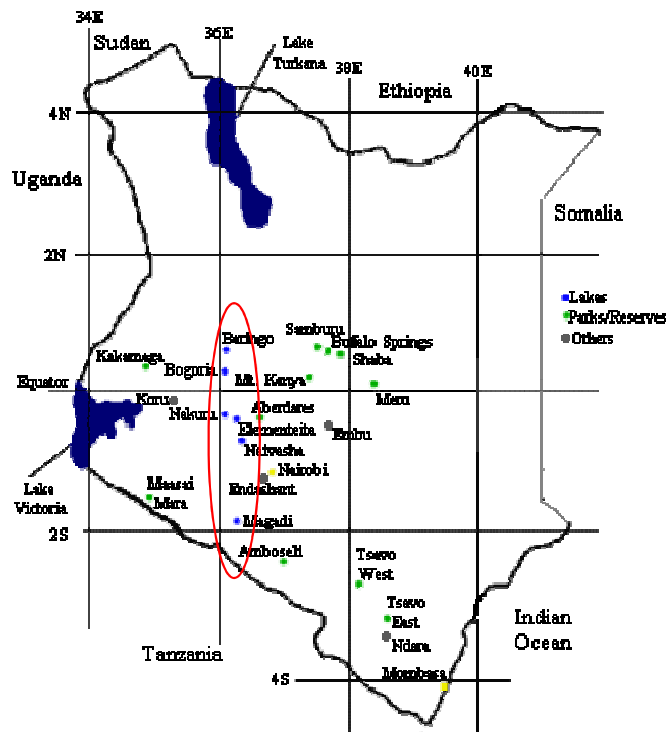


# 30 years of Soda Lakes Research in Kenya

Prof. Hamadi Iddi Boga  
Microbial Ecologist  
Principal Investigator

# Kenyan Soda Lakes



- Unique habitats
- Shallow basins about 1 m deep
- Highly productive ecosystems
- pH above 10
- Salinity ranging between 5 and 30‰ mostly due to NaCl and Na<sub>2</sub>CO<sub>3</sub>
- Hot springs present in some lakes (up to 100°C in Lake Bogoria)
- Characterized by steep physico-chemical gradients
- Support the growth of extremophiles

# Global occurrence of Soda

Soda Lakes Occur all over the world (Grant and Sorokin 2011)

Country	Lakes
Canada	Lake Manito
United States	Albert Lake, Lake Lenore, Soap Lake, Big Soda Lake, Owens Lake, Mono Lake, Searles Lake, Marsh, Harney Lake, Summer Lake, Pyramid Lake, Walker Lake
Mexico	Lake Texcoco
Hungary	Lake Feher
Russia	Tanatar Lakes
Turkey	Lake Van
India	Lake Loner, Lake Sambhar
China	Lake Chahannor; Lake Zabuye; Bange Lake; Lake Baer; Lake Wudunao; Lake Hamatai
Libya	Lake Fezzan
Egypt	Wadi Natrun
Ethiopia	Lake Aranguadi, Lake Kilotes, Lake Abiata, Lake Shala, Lake Chilu, Lake Hertale, Lake Metahara
Sudan	Dariba lakes
Kenya	Lake Bogoria, Lake Nakuru, Lake Elmentieta, Lake Magadi, Lake Simbi, Lake Sonachi
Tanzania	Lake Natron, Lake Embagi, Lake Magad, Lake Manyara, Lake Balangida, Bosotu Crater, Lakes, Lake Kusare, Lake Tulusia, El Kekhooito, Momela Lakes, Lake Lekandiro, Lake Reshitani, Lake Lgarya, Lake Ndutu, Lake Rukwa North
Uganda	Lake Katwe, Lake Mahega, Lake Kikorongo, Lake Nyamunuka, Lake Munyanyange, Lake Murumuli, Lake Nunyampaka
Chad	Lake Bodu, Lake Rombou, Lake Dijikare, Lake Momboio, Lake Yoan
Australia	Lake Corangamite, Red Rock Lake, Lake Werowrap, Lake Chidnup

# Research focus

- Geology
- Physico-chemistry
- Biology (Macro- and Microfauna, Macroflora, Mesoflora, Microbiota, Viruses)
- Bioprospecting
- Ecology



# Objectives of Research Studies

Discover and  
describe  
biodiversity

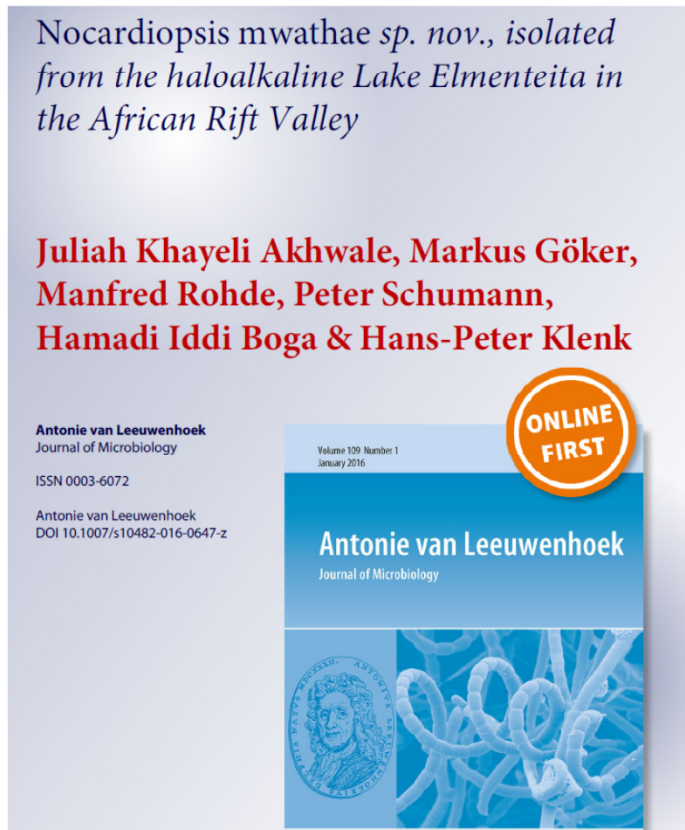
Function and  
activities of  
biodiversity  
components

Bioprospecting for  
novel compounds

Ecology

Conservation of  
biodiversity

# Described isolates



Correspondence  
Hans-Peter Klenk  
hpk@dsMZ.de  
Hamadi Iddi Boga  
hamadiboga@ttuc.ac.ke

## *Belliella kenyensis* sp. nov., isolated from an alkaline lake

Juliah Khayeli Akhwale,<sup>1,2</sup> Markus Göker,<sup>3</sup> Manfred Rohde,<sup>4</sup>  
Peter Schumann,<sup>3</sup> Hans-Peter Klenk<sup>3</sup> and Hamadi Iddi Boga<sup>5</sup>

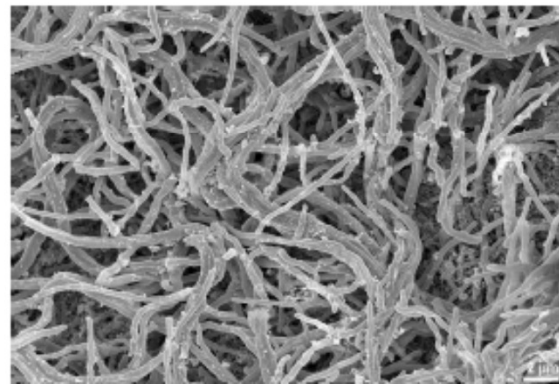
<sup>1</sup>Institute for Biotechnology Research, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya

<sup>2</sup>Leibniz Institute DSMZ – German Collection of Microorganisms and Cell Cultures, Braunschweig, Germany

<sup>3</sup>Leibniz Institute DSMZ – German Collection of Microorganisms and Cell Cultures, Inhoffenstraße 7B, 38124 Braunschweig, Germany

<sup>4</sup>HZI – Helmholtz Centre for Infection Research, Inhoffenstraße 7, 38124 Braunschweig, Germany

<sup>5</sup>Taita Taveta University College, P.O. Box 635-80300, Voi, Kenya

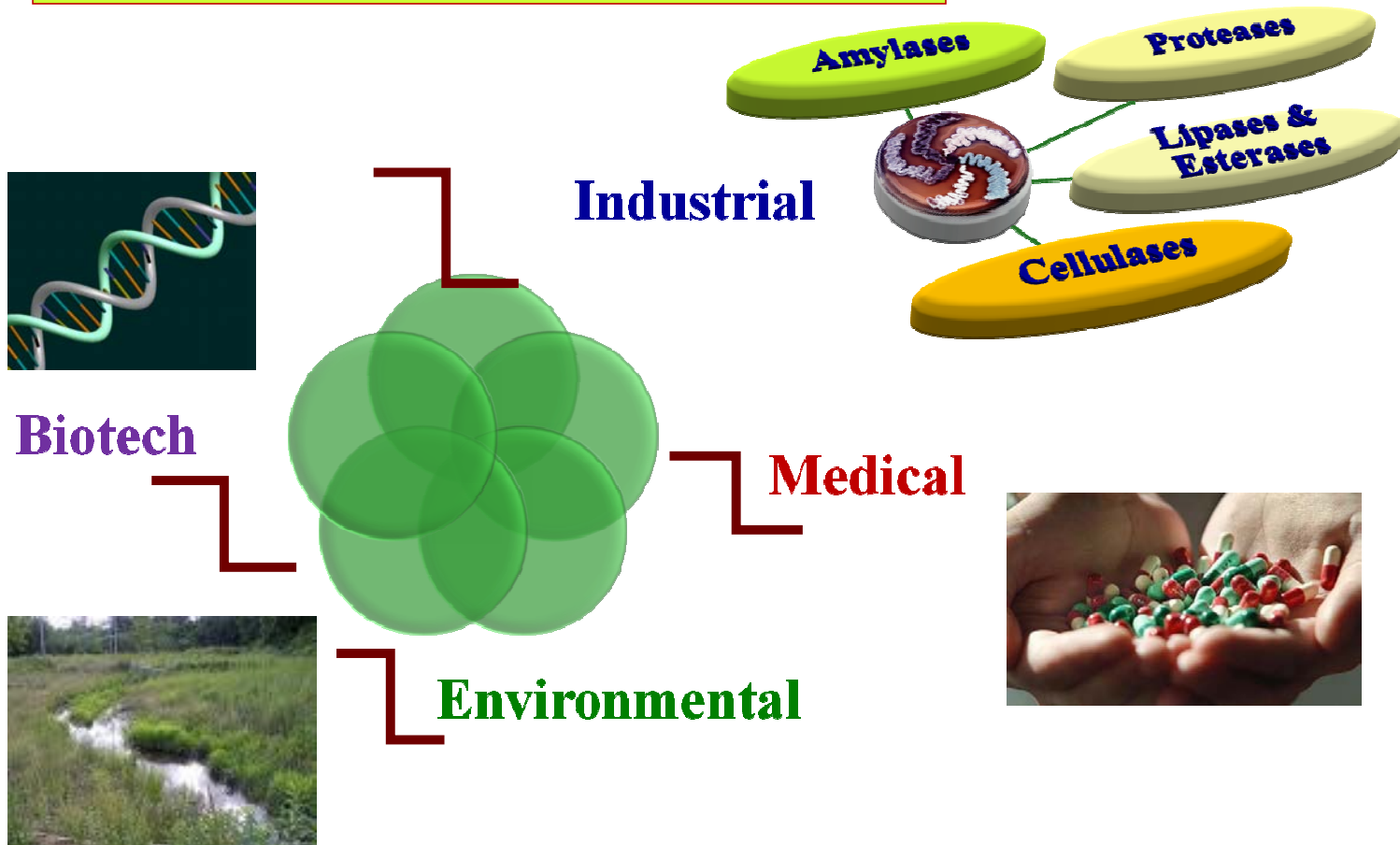


**Fig. 1** Scanning electron micrograph of strain No.156<sup>T</sup> grown on marine agar for 21 days at 28 °C (*bar*, 2 µm)



**Fig. 1.** Scanning electron micrograph of strain No.164<sup>T</sup> grown in marine broth for 3 days at 28 °C. *Bar*, 0.5 µm.

# Application of Extremophiles



# Real wealth from Soda Lakes

## *Enzymes from Kenyan Soda Lakes*

In 1998, Genencor commercialized an extremophile enzyme. **Puradax cellulase enzyme** was derived from a **new Bacillus species** found in the Rift Valley soda lake of East Africa during an expedition in 1992.

In 1999, Genencor introduced **IndiAge Neutra**, a cellulase derived from a new species of **strictly alkaliphilic Streptomyces**. The bacterium was isolated from the soda mud flats on the shores of the highly **alkaline Lake Nakuru** in Kenya. For economic production, the endocellulase gene was cloned and expressed in *Streptomyces lividans*. This innovative, **easy-to-use enzyme product, can treat denim to create the popular stonewashed look.**

# Soda Lakes Research Team

- Hamadi Boga-Principal Investigator
- Romano Mwirichia-PhD (JKUAT/DSMZ)
- Francis Ndwiga-PhD (JKUAT)
- Jackline Akanga-PhD (JKUAT/DSMZ)
- Anne Kelly Kambura-MSc/PhD (JKUAT)
- Odilia Salano-MSc/PhD (JKUAT)
- Julia Khayeli- MSc/PhD (JKUAT/DSMZ)
- Regina Ronoh –MSc (JKUAT)
- Huxley Mae Makonde-MSc/PhD
- Prof. Dr Hans Peter-Klenk –DSMZ/ University of Newcastle
- Prof. Erko Stackebrandt -DSMZ

# Approach

- International Collaboration Partnerships (GBRCN, DSMZ, CABI)
- MSc and PhD Training and Knowledge transfer
- Building Capacity in Kenya
- PIC (Communities/KWS)
- Research Permit (NACOSTI)
- Access Permits (NEMA)
- Material Transfer Agreements (KWS)
- Export License (KWS)